What is claimed is:

1. An air-fuel ratio control system for an internal combustion engine including a plurality of cylinders and an exhaust passage through which exhaust gases from the cylinders flow, the air fuel ratio control system controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

the air-fuel ratio control system comprising:

fuel amount-determining means for determining an amount of fuel to be supplied to each cylinder;

correction parameter-determining means for determining a correction parameter for correcting the amount of fuel to be supplied to each cylinder;

first fuel amount-correcting means for correcting the determined amount of fuel to be supplied to each cylinder, according to the determined correction parameter;

air-fuel ratio parameter-detecting means for detecting an air-fuel ratio parameter indicative of an air-fuel ratio of the exhaust gases flowing through the exhaust passage;

variation parameter-calculating means for calculating a variation parameter indicative of a variation in air-fuel ratio between the plurality of parameters, on a cylinder-by-cylinder basis, based on a model parameter of a model formed by modeling each cylinder and having an input of the correction parameter and an output of the air-fuel ratio parameter;

identification means for identifying the model

parameter of the model based on the determined correction parameter and the detected air-fuel ratio parameter; and

second fuel amount-correcting means for further correcting the amount of fuel to be supplied to the plurality of cylinders on a cylinder-by-cylinder basis such that the variation parameter calculated on a cylinder-by-cylinder basis converges to a predetermined target value.

2. An air-fuel ratio control system as claimed in claim 1, further comprising target value-setting means for setting an average value of the variation parameter to the predetermined target value.

3. An air-fuel ratio control system as claimed in claim 1, wherein said correction parameter-determining means determines the correction parameter such that the air-fuel ratio parameter is caused to converge to a predetermined target air-fuel ratio value.

4. An air-fuel ratio control system as claimed in claim 1, wherein the model parameter is of a model formed by modeling one of the plurality of cylinders, the correction parameter-determining means determining the correction parameter based on the model parameter, and

wherein said first fuel amount-correcting means corrects the mount of fuel to be supplied to all of the plurality of cylinders according to the determined correction parameter.

5. An air-fuel ratio control system as claimed in claim 1, wherein said second fuel amount-correcting means executes correction of the amount of fuel, based on one of an I-PD control algorithm and an IP-D control algorithm.

6. An air-fuel ratio control system as claimed in claim 1, wherein said second fuel amount-correcting means executes correction of the amount of fuel, based on a response-specified control algorithm.

7. An air-fuel ratio control system for an internal combustion engine including a plurality of cylinders, the air fuel ratio control system controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

the air-fuel ratio control system comprising:

first operating condition parameter-detecting means for detecting a first operating condition parameter indicative of an operating condition of the engine;

fuel amount-determining means for determining an amount of fuel to be supplied to each cylinder;

variation correction coefficient-calculating means for calculating a variation correction coefficient for correcting variation in air-fuel ratio between the plurality of cylinders, on a cylinder-by-cylinder basis;

learned value-calculating means for calculating a learned value of the variation correction coefficient according to the calculated variation correction coefficient and the detected first operating condition parameter; and

fuel amount-correcting means for correcting the determined amount of fuel to be supplied to each cylinder, according to the calculated learned value of the variation correction coefficient and the calculated variation correction coefficient.

8. An air-fuel ratio control system as claimed in claim 7, wherein said learned value-calculating means calculates the learned value of the variation correction coefficient, by a regression equation using the leaned value as a dependent variable and at the same time using the first operating condition parameter as an independent variable, and calculates a regression coefficient and a constant term of the regression equation by a sequential least-squares method.

9. An air-fuel ratio control system as claimed in claim 7, further comprising second operating condition parameter-detecting means for detecting a second operating condition parameter indicative of an operating condition of the engine, and

wherein when the detected second operating condition parameter is not within a predetermined range, said learned value-calculating means calculates the learned value of the variation correction coefficient, on a cylinder-by-cylinder basis, according to a value of the variation correction coefficient calculated when the detected second operating condition parameter was within the predetermined range.

10. An air-fuel ratio control system as claimed in claim 7, further comprising operating environment parameter-detecting means for detecting an operating environment parameter indicative of an operating environment of the engine, and

wherein when the detected operating environment parameter is not within a predetermined range, said learned value-calculating means calculates the learned value of the variation correction coefficient, on a cylinder-by-cylinder basis, according to a value of the variation correction coefficient calculated when the

detected operating environment parameter was within the predetermined range.

11. An air-fuel ratio control method for an internal combustion engine including a plurality of cylinders and an exhaust passage through which exhaust gases from the cylinders flow, the air fuel ratio control method including controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

the air-fuel ratio control method comprising:

a fuel amount-determining step of determining an amount of fuel to be supplied to each cylinder;

a correction parameter-determining step of determining a correction parameter for correcting the amount of fuel to be supplied to each cylinder;

a first fuel amount-correcting step of correcting the determined amount of fuel to be supplied to each cylinder, according to the determined correction parameter;

an air-fuel ratio parameter-detecting step of detecting an air-fuel ratio parameter indicative of an air-fuel ratio of the exhaust gases flowing through the exhaust passage;

a variation parameter-calculating step of calculating a variation parameter indicative of a variation in air-fuel ratio between the plurality of parameters, on a cylinder-by-cylinder basis, based on a model parameter of a model formed by modeling each cylinder and having an input of the correction parameter and an output of the air-fuel ratio parameter;

an identification step of identifying the model

parameter of the model based on the determined correction parameter and the detected air-fuel ratio parameter; and

a second fuel amount-correcting step of further correcting the amount of fuel to be supplied to the plurality of cylinders on a cylinder-by-cylinder basis such that the variation parameter calculated on a cylinder-by-cylinder basis converges to a predetermined target value.

12. An air-fuel ratio control method as claimed in claim 11, further comprising a target value-setting step of setting an average value of the variation parameter to the predetermined target value.

13. An air-fuel ratio control method as claimed in claim 11, wherein said correction parameter-determining step includes determining the correction parameter such that the air-fuel ratio parameter is caused to converge to a predetermined target air-fuel ratio value.

14. An air-fuel ratio control method as claimed in claim 11, wherein the model parameter is of a model formed by modeling one of the plurality of cylinders,

wherein said correction parameter-determining step includes determining the correction parameter based on the model parameter and

wherein said first fuel amount-correcting step includes correcting the mount of fuel to be supplied to all of the plurality of cylinders according to the determined correction parameter.

15. An air-fuel ratio control method as claimed in claim 11, wherein said second fuel amount-correcting step includes executing correction of the amount of fuel, based on one of an I-PD control algorithm and an

IP-D control algorithm.

16. An air-fuel ratio control method as claimed in claim 11, wherein said second fuel amount-correcting step executes correction of the amount of fuel, based on a response-specified control algorithm.

17. An air-fuel ratio control method for an internal combustion engine including a plurality of cylinders, the air fuel ratio control method including controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

the air-fuel ratio control method comprising:

a first operating condition parameter-detecting step of detecting a first operating condition parameter indicative of an operating condition of the engine;

a fuel amount-determining step of determining an amount of fuel to be supplied to each cylinder;

a variation correction coefficient-calculating step of calculating a variation correction coefficient for correcting variation in air-fuel ratio between the plurality of cylinders, on a cylinder-by-cylinder basis;

a learned value-calculating step of calculating a learned value of the variation correction coefficient, on a cylinder-by-cylinder basis, according to the calculated variation correction coefficient and the detected first operating condition parameter; and

a fuel amount-correcting step of correcting the determined amount of fuel to be supplied to each cylinder, according to the calculated learned value of the variation correction coefficient and the calculated variation correction coefficient.

18. An air-fuel ratio control method as claimed in claim 17, wherein said learned value-calculating step includes calculating the learned value of the variation correction coefficient, by a regression equation using the leaned value as a dependent variable and at the same time using the first operating condition parameter as an independent variable, and calculating a regression coefficient and a constant term of the regression equation by a sequential least-squares method.

19. An air-fuel ratio control method as claimed in claim 17, further comprising a second operating condition parameter-detecting step of detecting a second operating condition parameter indicative of an operating condition of the engine, and

wherein said learned value-calculating step includes calculating, when the detected second operating condition parameter is not within a predetermined range, the learned value of the variation correction coefficient on a cylinder-by-cylinder basis according to a value of the variation correction coefficient calculated when the detected second operating condition parameter was within the predetermined range.

20. An air-fuel ratio control method as claimed in claim 17, further comprising an operating environment parameter-detecting step of detecting an operating environment parameter indicative of an operating environment of the engine, and

wherein said learned value-calculating step includes calculating, when the detected operating environment parameter is not within a predetermined range, the learned value of the variation correction

coefficient on a cylinder-by-cylinder basis according to a value of the variation correction coefficient calculated when the detected operating environment parameter was within the predetermined range.

21. An engine control unit including a control program for causing a computer to perform an air-fuel ratio control process for an internal combustion engine including a plurality of cylinders and an exhaust passage through which exhaust gases from the cylinders flow, the air fuel ratio control process including controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

wherein the program causes the computer to determine an amount of fuel to be supplied to each cylinder, determine a correction parameter for correcting the amount of fuel to be supplied to each cylinder, correct the determined amount of fuel to be supplied to each cylinder, according to the determined correction parameter, detect an air-fuel ratio parameter indicative of an air-fuel ratio of the exhaust gases flowing through the exhaust passage, calculate a variation parameter indicative of a variation in air-fuel ratio between the plurality of parameters, on a cylinder-by-cylinder basis, based on a model parameter of a model formed by modeling each cylinder and having an input of the correction parameter and an output of the air-fuel ratio parameter, identify the model parameter of the model according to the determined correction parameter and the detected air-fuel ratio parameter, and further correct the amount of fuel to be supplied to the plurality of

cylinders on a cylinder-by-cylinder basis such that the variation parameter calculated on a cylinder-by-cylinder basis converges to a predetermined target value.

22. An engine control unit as claimed in claim 21, wherein the program causes the computer to set an average value of the variation parameter to the predetermined target value.

23. An engine control unit as claimed in claim 21, wherein the program causes the computer to determine the correction parameter such that the air-fuel ratio parameter is caused to converge to a predetermined target air-fuel ratio value.

24. An engine control unit as claimed in claim 21, wherein the model parameter is of a model formed by modeling one of the plurality of cylinders,

and wherein the program causing the computer to determine the correction parameter based on the model parameter, and

wherein when the program causes the computer to correct the amount of fuel to be supplied to each cylinder, the program causes the computer to correct the mount of fuel to be supplied to all of the plurality of cylinders according to the determined correction parameter.

25. An engine control unit as claimed in claim 21, wherein when the program causes the computer to further correct the amount of fuel to be supplied to the plurality of cylinders, on a cylinder-by-cylinder basis, the program causes the computer to correct the amount of fuel, based on one of an I-PD control algorithm and an IP-D control algorithm.

26. An engine control unit as claimed in claim

21, wherein when the program causes the computer to further correct the amount of fuel to be supplied to the plurality of cylinders, on a cylinder-by-cylinder basis, the program causes the computer to correct the amount of fuel, based on a response-specified control algorithm.

27. An engine control unit including a control program for causing a computer to perform an air-fuel ratio control process for an internal combustion engine including a plurality of cylinders, the air fuel ratio control process including controlling an amount of fuel to be supplied to each of the cylinders, on a cylinder-by-cylinder basis, to thereby control an air fuel ratio of a mixture supplied to each cylinder,

wherein the program causes the computer to detect a first operating condition parameter indicative of an operating condition of the engine, determine an amount of fuel to be supplied to each cylinder, calculate a variation correction coefficient for correcting variation in air-fuel ratio between the plurality of cylinders, on a cylinder-by-cylinder basis, calculate a learned value of the variation correction coefficient, on a cylinder-by-cylinder basis, according to the calculated variation correction coefficient and the detected first operating condition parameter, and correct the determined amount of fuel to be supplied to each cylinder, according to the calculated learned value of the variation correction coefficient and the calculated variation correction coefficient.

28. An engine control unit as claimed in claim 27, wherein the program causes the computer to calculate the learned value of the variation correction coefficient, by a regression equation using the leaned

value as a dependent variable and at the same time using the first operating condition parameter as an independent variable, and calculate a regression coefficient and a constant term of the regression equation by a sequential least-squares method.

29. An engine control unit as claimed in claim 27, wherein the program causes the computer to detect a second operating condition parameter indicative of an operating condition of the engine, and when the detected second operating condition parameter is not within a predetermined range, the program causes the computer to calculate the learned value of the variation correction coefficient on a cylinder-by-cylinder basis according to a value of the variation correction coefficient calculated when the detected second operating condition parameter was within the predetermined range.

30. An engine control unit as claimed in claim 27, wherein the program causes the computer to detect an operating environment parameter indicative of an operating environment of the engine, and when the detected operating environment parameter is not within a predetermined range, the program causes the computer to calculate the learned value of the variation correction coefficient on a cylinder-by-cylinder basis according to a value of the variation correction coefficient calculated when the detected operating environment parameter was within the predetermined range.